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Mechanical stimulation of the coeliac ganglion. A contribution to the physiology of the sympathetic nervous system.

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CYRIAX

Neue Veröffentlichungen.

Zum Begriff der Entwicklung.

Von **A. L. Angersbach.** Abdruck aus der „Naturwissenschaftlichen Wochenschrift“ herausgeg. von Prof. Dr. H. Potonié und Prof. Dr. F. Koerber. 1912. N. F. XI. Band. (126 S. kl. 8°.) 1913. Preis: 2 Mark.

Inhalt: 1. Kennzeichen der Entwicklung körperlicher Systeme.
2. Nervöse und geistige Entwicklung.

Das Problem der Funktionen des Nervensystems.

Von **S. Baglioni,** Rom. (Sonderabdruck aus der „Naturwissenschaftlichen Wochenschrift“, herausgegeben von Prof. Dr. H. Potonié und Prof. Dr. F. Koerber. N. F XI. Bd.) 1912. Preis: 1 Mark.

Eine so schwierige Frage wie die von den Funktionen des Nervensystems von einem sachkundigen Verfasser klar dargestellt zu sehen, wird weite Kreise der Biologen fesseln. Da das Problem seiner Lösung noch harrt, so handelt es sich hier um einen orientierenden Ueberblick, der um so wichtiger ist, als gerade hier durch die Fortschritte der Forschung die Zahl der Streitfragen gewachsen ist. Der Vortrag wurde gehalten auf der IV. Versammlung der Società Italiana per il Progresso della Science.

Biomechanik und Biogenesis.

Von Prof. Dr. **Moriz Benedikt.** Zweite ergänzte Ausgabe des Buches: Das biomechanische (neo-vitalistische) Denken in der Medizin und Biologie. 1912. Preis: 2 Mark.

Inhalt: Einleitung. 1. Teil: Das biomechanische Denken in der Biologie. Die Biomechanik des Zellenlebens. — Die Fernwirkung der Zellen. — Die Fernwirkung mittels des Saftstromes. — Die Fernwirkung mit Hilfe des Nervensystems. — Die Nervenfernwirkung in der Biomechanik des Wachstums. — Die Trophoneurosen. — Die krankhafte Fernwirkung innerhalb des Zentralnervensystems. — Die Neuronenfrage. — Einige allgemeine biomechanische Gesetze: Das Grundgesetz der Lebensäußerungen. Das biomechanische Minimalgesetz. Das biomechanische Luxusgesetz. — Biomechanik des Wachstums. — Die Biomechanik des Blutstroms. — Zur Biomechanik des Nerven-Muskelapparats. — Die Biomechanik der Fortpflanzung. — 2. Teil: Die Naturgeschichte des Seelenlebens. Das Seelenleben. — Vom Bau des Gehirns und seiner Oberfläche. — Der geometrische Bau des Schädels und der Knochen. — Das richtige Sehen des verkehrten Netzhautbildes. — 3. Teil: Biogenesis.

Richtlinien des Entwicklungs- und Vererbungsproblems.

Von Dr. **Alfred Greil,** a. o. Prof. der Anatomie an der Universität Innsbruck.

Erster Teil: **Prinzipien der Ontogenese und des biogenetischen Grundgesetzes.** Beiträge zur allgemeinen Physiologie der Entwicklung. (Erweiterter Sonderabdruck aus „Zoolog. Jahrbücher“, herausg. von Prof. Dr. J. W. Spengel in Gießen. Bd. 31. Abt. f. allg. Zoolog. u. Physiol.) 1912. (IV, 352 S. gr. 8°.) Preis: 10 Mark.

In dem vorliegenden Werk handelt es sich um eine Klärung von Kontroversen über allgemeine, prinzipielle, kardinale Fragen des Vererbungsproblems und um einen Kampf an der Seite Haeckelscher Lehren mit gegnerischen Ansichten, den der Verfasser der wissenschaftlichen Wahrheit schuldig zu sein glaubt. So leuchtet er in manchen versteckten Winkel des Problems hinein und macht die Schrift zu einer ganz aktuellen und dringlichen Angelegenheit für jeden Zoologen, Anatomen, Botaniker, Histologen und Embryologen. In klarer, faßlicher Darstellung behandelt er Prinzipien der Entwicklungs- und Vererbungslehre und die Methodik der Forschung.

Zweiter Teil: **Anpassung und Variabilität, Ererbung und Erwerbung, Geschlechtsbestimmung. Entwicklungs- und Vererbungstheorien.** Grundzüge der allgemeinen Morphobiologie und Entwicklungsdynamik. 1912. (IV, 364 S. gr. 8°.) Preis: 10 Mark.

Der Darstellung der Prinzipien der Ontogenese und des biogenetischen Grundgesetzes im ersten Teil dieses Werkes, welche aus der embryologischen Praxis entstanden und zum Gebrauche bei deskriptiven Analysen der Entwicklung bestimmt ist, läßt der Verfasser in diesem zweiten Teil eine Weiterführung des angestrebten methodischen Systemes zur Beurteilung allgemeinerer und biologischer Fragen von stammesgeschichtlichem Belange folgen. Wendete sich der erste Teil vorwiegend an Anatomen und Zoologen und wollte er zur Ergänzung der Lehr- und Handbücher der Entwicklungsgeschihcte dienen, so wendet sich der zweite Teil vorzugsweise an Biologen im engeren Sinne und an Vererbungstheoretiker, denen an einer genauen [illegible] Grundlagen des Vererbungsproblems gelegen ist.

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Mechanical stimulation of the coccygeal ganglion.

A contribution to the physiology of the sympathetic nervous system.

By

Edgar F. Cyriax, M. D., and **Richard J. Cyriax**, M. R. C. S., L. R. C. P.

(Der Redaktion zugegangen am 2. Oktober 1912.)

Introduction.

In the study of the Swedish manual treatment for the cure or alleviation of diseased conditions, a certain amount of work has been done on the state of the abdominal sympathetic in relation to disease of the abdominal viscera. The motor functional capacity of the abdominal sympathetic cannot be directly judged of in the human being, but it appears to be highly probable that the sensory functional capacity is a very good guide to it. The sensory condition of the abdominal sympathetic is tested for either by the ordinary process of deep palpation or, better still, by executing a "friction" over it. These methods of testing the sensibility of the abdominal sympathetic have been described elsewhere, and the reader is referred to the original papers for further details (1).

Whether the portion of the abdominal sympathetic tested for in the manner alluded to be the deep plexuses, which can be reached through the anterior abdominal wall, or the coccygeal ganglion, which can be reached on the anterior aspect of the coccyx, through the skin or through the interior of the rectum, certain sensory

effects are normally elicited. The patient experiences a feeling which is somewhat unpleasant, and even in health may be very painful. The nature of this sensation is not quite the same as that resulting from mechanical stimulation of cerebro-spinal nerves, and we shall therefore refer to it as a "sympathetic sensation". In addition to the latter, stimulation of the abdominal sympathetic in healthy persons may cause both motor and vasomotor phenomena. Under the first category may be mentioned eructations, desire to micturate or defaecate, occurring after a latent period of a few seconds or more; under the second, flushing of the face. All these phenomena are not necessarily elicited in the same individual.

In abnormal cases sympathetic sensation is increased, diminished, or absent, depending upon the nature and severity of the disease. The amount of sensation in the abdominal sympathetic is to our minds a good index to the state of functionability in the latter; in many cases it follows very closely the variations that take place in the abdominal disorder with which it appears to be connected. However, in some cases of undoubted abdominal trouble, sympathetic sensation has been found to be normal.

During the last fourteen years' practice of one of us (E. F. C.) and the last three years' practice of the other (R. J. C.) we have regularly and systematically investigated sympathetic sensation in the abdomen and its relation to abdominal disease. Some of the results obtained have already been published (2). We have found, for instance, that, in some cases of constipation, sensation is diminished or absent in the coccygeal ganglion, and, in other cases, in the abdominal sympathetic chain. Diminution of sensation in the area of skin supplied by the fourth sacral nerve has also been found frequently to accompany the former condition.

The researches of HEAD and of others have shown that excessively active, irritated, or inflamed conditions of abdominal organs are constantly accompanied by increased irritability in the area of skin supplied by that segment of the spinal cord to which run the sensory nerves from the affected viscera. It does not seem, however, to have been generally recognised that paretic, atonic, or inactive conditions of abdominal organs are accompanied by diminished sensation in the corresponding spinal area. Our observations appear to show, however, that such is the case. The cutaneous area for the rectum, as estimated by HEAD, is that supplied by the 2nd, 3rd, and 4th sacral nerves. As we have found that the area supplied by the latter nerve is often less sensitive than normal in

chronic constipation, we presume that, in these cases, the source of trouble is to be chiefly looked for in the rectum.

The researches of Dr. ARTHUR HERTZ (3) have led him to the conclusion that, generally speaking, all cases of chronic constipation can be divided into two classes — intestinal constipation and dyschezia. The first variety is said by Dr. HERTZ to be due to the faeces being delayed on their passage through the intestine, defaecation being normal. The second variety is due to inadequate expulsion, no delay occurring in the passage of faeces through the intestine. Dr. HERTZ considers that the normal call to defaecation is produced by an increase of tension in the rectal walls brought about by the sudden entry of faecal matter into the rectum, which is normally empty. If the call to defaecation is for any reason neglected, the sensation of rectal distension passes off, owing to relaxation of the muscular tissue in the rectal walls. A condition of rectal atony is thereby slowly produced, an abnormally large quantity of faeces being required to cause an increase of rectal tension which is sufficient to produce the call to defaecation. Dr. HERTZ also believes that the muscle sense of the rectum, upon which the call depends, is only impaired in extreme and in congenital cases, and that dyschezia is generally dependent upon an atonic dilatation of the rectum.

In view of Dr. HERTZ's researches, we are inclined to think that those cases of chronic constipation in which we found the sensibility of the coccygeal ganglion and the cutaneous area supplied by the 4th sacral nerve to be impaired corresponded to the type of constipation referred to by Dr. HERTZ as dyschezia; and that those cases in which the sensibility of the abdominal sympathetic was sub-normal were of the type described by the same author as intestinal constipation. We did not make any intra-rectal examination in our cases, however, and hence make this suggestion quite tentatively.

It has already been mentioned that the state of sensibility of the sympathetic often follows very closely the variations that take place in the abdominal disorder with which it is seemingly connected. This is especially true as regards sensation in the coccygeal ganglion in some cases of chronic constipation. We have repeatedly noted the sensibility of the ganglion is increased in these cases when the condition improves, as shown by the occurrence of a motion, and vice versa.

In a previous paper (4), one of the authors has described the

technique of the gymnastic treatment of chronic constipation as we employ it, and has drawn attention to manual stimulation of the coccygeal ganglion in this condition. It is the latter procedure alone that we propose to discuss in this paper. The other manipulations and exercises that form an integral part of the treatment need not be described here. We would merely like to mention that we never use either the direct or indirect sympathetic method (5) by itself but only in conjunction with other procedures.

Why sympathetic sensation in the coccygeal ganglion should be impaired in some cases of chronic constipation is by no means clear. We have often found that the abdominal sympathetic chain is as sensitive as normal when the coccygeal ganglion is almost anaesthetic, and the latter condition cannot, therefore, be due to a lowering of the sensibility of the sympathetic chain as a whole. We have never tried to ascertain in these cases whether the sacral sympathetic is also insensitive or less sensitive than normal, owing to the great difficulty of reaching it in the human being, and we are therefore not in a position to say whether it shares in the sensory disturbance in the coccygeal ganglion or not.

It appears, therefore, that the insensibility of the latter in some cases of chronic constipation is largely a local condition, in which the sacral sympathetic may or may not share. It has been already mentioned that mechanical stimulation of the ganglion in man may cause a desire to micturate or defaecate. In order to study these phenomena more closely than is possible in man, we decided to try the effect of stimulating the coccygeal ganglion in animals, as a preliminary step towards the elucidation of some of the problems connected with the pathology of the pelvic sympathetic. An abundance of experimental work has been performed on the abdominal sympathetic, and the innervation of the pelvic viscera has been thoroughly investigated by Drs. LANGLEY and ANDERSON (6), but we have been unable to find an account of any experiments performed especially upon the coccygeal ganglion. Our original intention was to ascertain what effect — if any — stimulation of the coccygeal ganglion had upon the rectum; but, at the suggestion of Prof. STARLING, observations were included on the concurrent changes in the general blood-pressure. All the experiments were carried out in the Physiological Laboratory of University College, London, by permission of Prof. STARLING, to whose kindness and help we are greatly indebted.

Experimental Work.

Twenty-three experiments were performed, all upon dogs. Anaesthetics were used in all cases. A dose of morphia, varying in accordance with the size of the dog, from a quarter to three-quarters of a grain, was administered some hours previous to the experiment, and the animal further anaesthetized with chloroform alone or followed by ether or A.C.E. mixture. The blood-pressure was ascertained by means of a mercurial manometer connected with a cannula placed in the carotid artery, except in one instance, in which the femoral was chosen for convenience of manipulation. In some experiments the respiratory movements were recorded, and, when this was done, the apparatus employed was a stethograph connected with a MAREY's tambour.

In order to record the movements of the lower part of the descending colon and upper part of the rectum (7), the abdomen was opened by an incision through the linear alba, and a cross cut at right angles to this. An india-rubber bag was then placed within the lumen of the gut, at the situation mentioned, and was connected with an apparatus for regulating the pressure within the bag, which in its turn was joined to a MAREY's tambour or similar apparatus. Cooling of the viscera was prevented by covering the exposed parts with cotton-wool or flannel wrung out of warm water.

Before any experiments upon living animals were performed, some dissections were carried out in dead ones, in order to ascertain the best route of approaching the ganglion. During these preliminary dissections the relative merits of the following avenues of approach were ascertained: I, dividing the pubic symphysis, removing part of the pubes on each side, and thus reaching the ganglion from the dog's ventral aspect, and II, dissecting from the perineum between the rectum and coccygeal vertebrae, and thus reaching it from the anal region. Although the former method enabled the ganglion to be reached with comparative ease in a dead dog, the haemorrhage, shock, disturbance of viscera and inevitable section of important structures that resulted in a living animal rendered the pubic route undesirable, and hence the perineal route was the one universally adopted. In three experiments the pubic bones were removed, but this was done to enable the rectum to be observed in its entirety.

The dissection necessary to expose the coccygeal ganglion by the perineal route was a long and difficult one, largely due to pro-

fuse haemorrhage from numerous small arteries. A transverse incision was made through the skin half-way between the outer limit of the anal skin and the caudal vertebrae. The deep fascia was then removed, and the anus and lower part of the rectum separated from the tail muscles, their ventral connections being left intact. The tail was freed on both sides in the direction of the abdominal cavity, and bent towards the dog's dorsal aspect. By separating the ventral caudal muscles from one another up the middle line, a few small blood-vessels and nerves were exposed, which formed a convenient guide to the ganglion.

The ganglion which formed the subject of these experiments was the one lying on the first coccygeal vertebra. It is generally found in the centre of the latter's ventral surface, but its position is somewhat variable within slight limits. From its lower and springs a small bundle of fibres, which pass down the tail, to disappear gradually.

The ganglion in question was stimulated by electrodes led off the secondary circuit of an ordinary induction coil, so that the strength of stimulation could be varied at will. A side-wire from the primary circuit was connected with an apparatus for recording the duration of stimulation; a timemarker was also employed. The points of the electrodes were sharp, and placed close together. The best place for them was found to be between the ganglion end the vertebra upon which it lay. Escape of current and possible contact between the electrodes and the rectum was guarded against as much as possible by surrounding the points of the former with cotton-wool, packed in after they were in position. When there, they were kept in place throughout the entire experment, in order to avoid damaging the ganglion by repeated insertion.

The first twelve experiments were performed in order to ascertain what changes were produced in the general blood pressure by stimulation of the ganglion. Of these dozen experiments, the first eight were performed with the dog under an anaesthetic throughout; in six of these, the respiratory movements were recorded. In order to avoid any possibility of cerebral reflexes, the remaining four experiments of the first twelve were performed on dogs that had been decerebrated through a trephine opening in the right temporal region of the skull under a preliminary anaesthetic. Both carotid arteries were ligatured at the level of the upper end of the trachea before decerebration was performed. Artificial respiration, by means of a bellows connected with a tracheal cannula,

was necessary, and rendered it unnecessary to record the respirations. As a rule, both vagi had to be cut shortly after decerebration, to prevent stoppage of the heart owing to pressure upon the medulla oblongata caused by intracranial haemorrhage. The animal was generally kept on a hot water bag. The remaining experiments, eleven in all, were performed upon decerebrated dogs, and the general blood pressure and movements of the lower part of the descending colon and upper part of the rectum, were recorded in the manner already indicated.

Results.

The effect produced by stimulation of the coccygeal ganglion on the parts of the colon and rectum already referred to was found to consist chiefly of a contraction of the circular muscle-fibres, so that the intestine became ringed. This effect was obtained after stimulating for about four seconds. The longitudinal coat was also affected, but, as far as could be seen, to a less extent than the circular. The gut was not visibly dragged towards the anus. The contraction was never so strong as to obliterate its lumen, nor did the intestine become rod-like. The part chiefly affected was at about the junction of the descending colon and the rectum; as far as could be seen with the naked eye, the remainder of the colon did not participate. In those experiments in which the pubic bones were partly removed, and the bladder held aside, it was seen that the lower part of the rectum remained passive, and that the contraction was chiefly confined to the site mentioned, and about a finger's breadth below it.

A good effect was obtained with one cell in the primary circuit of the induction coil provided that the secondary coil was not more than twenty centimetres from the primary coil; when placed further away, no affect was obtained.

In two experiments, after the ganglion had been twice stimulated, the second resulting contraction of the gut was followed by a series of peristaltic waves passing downwards along the upper part of the rectum, which had been practically quiescent when the contraction, produced by stimulation of the ganglion, had passed off. Each of these waves produced a rise of the lever connected with the bag inside the gut that lasted about twenty seconds, and was almost immediately followed by another. The bag inside the gut was about an inch and a quarter long. Stimulation of the ganglion

during the passage of these waves had only a slight effect; it increased the magnitude of the peristaltic contractions, but did not influence their rate of production, either during its performance or after.

During stimulation of the ganglion, the anus was seen to be retracted, while slight twitchings occurred around its orifice, chiefly anteriorly. These were probably reflex in origin, or due to escape of current. Removal of the anus and lowest two inches of the rectum did not abolish the contractions of the intestine higher up. Stimulation of the anterior crural nerve had no effect, nor did that of the sympathetic cords on the first piece of the sacrum, close to the promontory; our observations on the effect of these procedures were confined to the intestine. If the sympathetic nerves were cut immediately proximal to the ganglion, it was found that stimulation of the latter was without effect on the gut. When the rectum was entirely isolated from all its connections, except with the colon, between the pelvic brim and the anus, no contraction was produced by stimulating the ganglion.

It was noticed that a distended bladder inhibited the effect on the intestine, but the latter was obtained after a short interval when the urine had been expressed. No other result was noticed as regards the bladder.

Two experiments were failures as far as intestinal contractions were concerned; this is perhaps to be attributed to the loss of blood which exposure of the ganglion entailed, and consequent loss of sensibility in the latter.

The effects produced, by stimulation of the coccygeal ganglion, upon the general blood-pressure, were found to be slight and inconclusive. The reflex movements of the dogs in the first eight experiments were doubtless responsible for the slight rise of pressure which generally ensued about five seconds after stimulation was begun. In two experiments out of the first eight, however, the pressure fell slightly during stimulation, although the latter was accompanied by reflex movements; but the tracings showed that the dog's respirations markedly increased both in volume and frequency, which was probably the cause of the fall. In the experiments performed upon decerebrated dogs, the blood-pressure, as a rule, slightly increased; if not, it remained stationary. The changes in blood-pressure in the decerebrated animals were less than in those in which continous anaesthesia was employed. Dividing the vagi

seemed to have no effect on their character. All these changes, as has been mentioned, were extremely slight.

No observations were made on such phenomena as erection of hairs on the tail, dilatation of the internal sphincter, and so on, as was done by Drs. LANGLEY and ANDERSON during their researches into the innervation of the pelvic viscera, etc.(8)

Conclusion.

The route by which the impulses reach the rectum from the coccygeal ganglion does not seem clear. The effects produced upon the former by stimulation of the latter may be either reflex from the spinal cord, or due to impulses passing along fibres which run to the rectum directly from the ganglion, presumably through the pelvic plexus. If the latter supposition is correct, it is difficult to understand why the sensibility of the ganglion should be impaired in some cases of chronic constipation. On the other hand, on the three occasions when stimulation of the sacral sympathetic trunks on the first piece of the sacrum was tried, no effect upon the rectum was noticed. We are therefore not in a position to say how the impulses reach the rectum; in order to answer this question more extended researches would have to be undertaken.

Another doubtful point is whether the disturbance in sensibility in the coccygeal ganglion is a cause or effect of some cases of chronic constipation. This question is very difficult to decide. We do not think that insensibility of the ganglion in these cases is a purely local condition; we are more inclined to regard it as an index to the condition of the sacral sympathetic; but, for reasons which have been given in a previous paragraph, this hypothesis has not been verified.

Whatever be the true explanation of these doubtful points, there can be no doubt of the beneficial effect produced by mechanical stimulation of the coccygeal ganglion in certain cases of chronic constipation. It will frequently succeed when all other methods have failed. The technique of its application, and other points in connection with its employment as a therapeutic measure have been dealt with elsewhere (9), and need not be discussed here. We would, however, like to point out once more that we never employ mechanical stimulation of the ganglion by itself, but always in conjunction with other procedures.

In the following list will be found particulars of fifteen cases of chronic constipation, in which sensibility in the coccygeal ganglion was abnormal. They were all treated by mechanical stimulation of the latter; the remainder of the treatment adopted was that outlined by one of the authors in a previous article [10].

Zusammenfassung.

1. In Fällen von chronischer Obstipation wird gewöhnlich das Ganglion coccygeum des Menschen unempfindlich gegen mechanische Reizung, wenn eine Friktion durch die Haut mit dem Finger in der Aftergegend ausgeführt wird. Die Empfindlichkeit des Ganglion richtet sich nach dem Zustande der Obstipation. Verminderte Empfindlichkeit in dem Ganglion ist oft verbunden mit verminderter Empfindung in jener Hautregion, die durch den vierten Kreuzbeinnerv versorgt wird.

2. Einer Reizung des ersten Ganglion coccygeum beim Hunde durch Induktionsstrom folgt nach einer latenten Periode von ca. 4 Sekunden eine Zusammenziehung der Zirkularmuskelfasern an dem Vereinigungspunkt des absteigenden Grimmdarms und des Mastdarms. Die Längsmuskelfasern erscheinen ebenfalls beeinflußt, aber in geringerem Maße als die Zirkularmuskelfasern. Der Rest des absteigenden Grimmdarms und der Mastdarm scheinen nicht beeinflußt zu sein. Die hervorgebrachte Zusammenziehung ist nicht genügend stark, um die Darmhöhlung völlig zu schließen. Der Darm wird nicht unbiegsam hart, noch wird er nach dem After heruntergezogen. Der Reizung des Ganglion folgen zeitweise peristaltische Wellen, die sich bis hinab auf den bisher unbeeinflußt gebliebenen Darm erstrecken.

Die Veränderungen des allgemeinen Blutdrucks sind gering und nicht charakteristisch.

3. Der Weg, auf dem die Impulse den Mastdarm vom Ganglion coccygeum erreichen, ist unbestimmt.

4. Mechanische Reizung des Ganglion coccygeum beim Menschen ist in Fällen von chronischer Obstipation sehr wertvoll, wenn diese Vornahme mit anderen Maßregeln verknüpft ist. Ob der Empfindlichkeitszustand des Ganglion primär oder sekundär ist, steht nicht fest, doch scheint er sekundär zu sein.

No.	Initials	Age.	Sex.	Duration of illness	Condition of the coccygeal ganglion	No. of treatments	Period over which latter extended	Remarks
1	E	45	M	31 yrs.	No sensation	39	9 wks.	Ganglion normal. Well 2½ yrs. later.
2	W	45	M	3 wks.	No sensation	10	14 dys.	Motion daily; ganglion very sensitive.
3	S	50	F	6 yrs.	No sensation	14	3 wks.	Improved; coccygeal ganglion still rather insensitive.
4	M	36	M	7 yrs.	No sensation	23	39 dys.	Motion almost daily; ganglion normal.
5	B	60	M	3 yrs.	No sensation	25	29 dys.	Ganglion fairly sensitive. Keeping well 15 months later: ganglion normal.
6	X	24	F	6 yrs.	No sensation	Treated at intervals of about six months during three years;		constipation much improved; ganglion normal.
7	W	26	M	5 yrs.	No sensation	12	23 dys.	Ganglion normal. Remained well until 18 months later, when the ganglion was found rather insensitive.
8	L	46	M	6 mths.	Diminished sensat.	10	14 dys.	Motion daily; ganglion normal.
9	W	37	F	5 yrs.	No sensation	92	6 mths.	Motion daily as a rule.
10	P	48	M	5 yrs.	Greatly diminished sensation	25	5 mths.	Motion almost daily. Ganglion not sufficiently sensitive.
11	L	53	M	15 yrs.	No sensation	21	1 mth.	Cured; ganglion normal.
12	T	21	M	7 yrs.	Diminished sensat.	29	2 mths.	
13	W	40	F	12 yrs.	No sensation	75	1 yr.	Motion almost daily; ganglion still rather insensitive.
14	D	21	M	6 yrs.	Diminished sensat.	40	3 mths.	Very much improved; ganglion normal.
15	T	37	F	2 yrs.	No sensation	36	7 wks.	Motion daily.

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6. Journal of Physiology, Vols. 18, 19, 20, 1895, 1895—1896, 1896.
7. These terms are employed in the same sense in which they were used by Drs. LANGLEY and ANDERSON. Journ. Physiol., Vol. 18, 1895, p. 75.
8. Journ. Phys., Vol. 18, pp. 67 et seq.
9. E. F. and A. K. CYRIAX, New York Med. Journ., July 23, 1910.
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Neue Veröffentlichungen.

Die Methode der Wissenschaft und andere Reden.

Von **Charles S. Minot,** L. L. D., Hon. D. Sc., Prof. der vergleichenden Anatomie an der Harvard Medical School, Austausch-Professor an der Königl. Friedrich Wilhelms-Universität Berlin, Präsident der Boston Society of Natural History, Mitglied der National Academy in Washington. Uebersetzt von Dr. **Joh. Kaufmann** (Bonn). 1913. VIII, 205 S. gr. 8°.) Preis: 5 Mark.

Inhalt: Die Aufgabe des Naturforschers in der Welt. — Wissen und Praxis — Die embryologische Basis der Pathologie. — Das Problem des Bewußtseins in seinen biologischen Beziehungen. — Genetische Interpretationen auf dem Gebiete der Anatomie. — Die Beziehungen der Embryologie zu den Fortschritten der Medizin. — Gewisse Ideale der ärztlichen Ausbildung. — Die Methode der Wissenschaft. — Die Lage der Naturforschung in Amerika.

Diese Reden, die beim Antritt des Vorsitzes von gelehrten Gesellschaften oder bei akademischen Feiern gehalten wurden, beschäftigen sich mit allgemeinen Fragen und geben in ihrer Gesamtheit die Lebensanschauungen eines biologischen Forschers wieder. Sie handeln von den Beziehungen der Biologie zum Fortschritt der Menschen, zum Unterricht, zur Medizin und zur Philosophie. Eine der Reden erörtern das Problem des Bewußtseins von einem neuen Standpunkt. In der „Methode der Wissenschaft" ist diese Methode zum ersten Male dem Tatbestand entsprechend analysiert und dargestellt worden.

Moderne Probleme der Biologie.

Sechs Vorträge, gehalten an der Universität Jena im Dezbr. 1912. Von **Charles Sedgwick Minot,** L. L. D., Yale, Toronto und St. Andrews: Hon. D. Sc., Oxford, Prof. der vergleichenden Anatomie und Direktor des anatomischen Laboratoriums an der Harvard Medical School, Boston, Mass.- Präsident der Boston Society of Natural History, Mitglied der National Academy, Washington. Mit 53 Abbildungen im Text. 1913. Preis: 3 Mark.

Inhalt: 1. Die neue Zellenlehre. — 2. Die Cytomorphose. — 3. Die Unsterblichkeit. — 4. Die Entwicklung des Todes. — 5. Die Bestimmung des Geschlechtes. 6. Der Begriff des Lebens.

Vergleichende Physiologie wirbelloser Tiere.

Von Prof. Dr. **H. Jordan.** Erster Band. **Die Ernährung:** Nahrung, Nahrungserwerb, Nahrungsaufnahme, Verdauung und Assimilation. Mit 277 Abbildungen im Text. (XXII, 738 S. gr. 8°.) 1913. Preis: 24 Mark, geb. 26 Mark 50 Pf.

Es ist die Aufgabe des vorliegenden Buches, die eigentlichen Lebenserscheinungen (bei Wirbellosen) in größtmöglicher Einheitlichkeit vorzutragen: es wird hier die Physiologie recht eigentlich von ihrer „biologischen" Seite, im modernsten Sinne des Wortes, dargestellt. So ruht das Schwergewicht der Bearbeitung auf den Abschnitten über Ernährung, Blut, Atmung, Stoffwechsel, Exkretion, Bewegung, Nervensystem, Sinnesorgane, „Psychologie". Der Stoff ist wirklich verarbeitet, nicht etwa nur in einer Reihe von Referaten aneinandergereiht, also ein jeweils in sich geschlossenes einheitliches Bild von jedem Vorgang entworfen. Das Buch ist bestimmt, sowohl dem Gelehrten das Material und einige Anregung zu geben, wie dem Lernenden und Aufschlußsuchenden eine vollkommene Einführung in das große Gebiet zu geben. Der Zoologe, wie der Biologe überhaupt, der Mediziner und der anatomische Forscher werden dieses Werk als eine Bereicherung der Fachliteratur gern begrüßen.

Vademecum anatomicum.

Kritisch-etymologisches Wörterbuch der systematischen Anatomie. Mit besonderer Berücksichtigung der Synonymen. Nebst einem Anhang: Die anatomischen Schriftsteller des Altertums bis zur Neuzeit. Von Dr. **Paul de Terra,** Zollikon-Zürich. 1913. (XVI, 648 S. 8°.)

Preis: 15 Mark, geb. 16 Mark.

Ein Wörterbuch, das die ganze Anatomie umfaßt und jeden anatomischen Teil des menschlichen Körpers aufführt, hat bisher noch nicht existiert und wird für weitere Kreise, die sich über die medizinischen Bezeichnungen orientieren wollen, von Bedeutung sein. Gerade auch um deswillen, weil es die Synonyma systematisch berücksichtigt, wird es außer für die Studenten auch für die praktischen Aerzte von nicht zu unterschätzendem Nutzen sein und ganz besonders für alle solche, die auf diesen Gebieten literarisch tätig sind.

Die Zelle der Bakterien.

Vergleichende und kritische Zusammenfassung unseres Wissens über die Bakterienzelle. Für Botaniker, Zoologen und Bakteriologen. Von Dr. **Arthur Meyer,** o. Prof. der Botanik und Direktor des botanischen Gartens und des botanischen Instituts der Universität Marburg. Mit 1 chromolithographischen Tafel und 34 Abbildungen im Text. 1912. Preis: 12 Mark, geb. 13 Mark.

Inhalt: I. **Vorrede.** — II. **Die Umgrenzung der Eubakterien und die zu den Eubakterien zu rechnenden Gattungen.** — III. **Die Stellung der Eubakterien im Organismenreiche.** — IV. **Die Zelle der Bakterien.** 1. Die Größe der Bakterienzelle. 2. Allgemeines über den Bau der Bakterienzelle. 3. Der Zellkern. Historisches. Eigene Beobachtungen. 4. Das Zytoplasma. 5. Die Plasmodesmen. Allgemeines. Die Plasmodesmen der Bakterien. 6. Die Geißeln. Allgemeines. Die Geißeln der Bakterien. 7. Die Membran der Zellfäden, Oidien und Sporangien. Morphologie und Biologie der Membran. Die Chemie der Membran der Bakterien. 8. Die Zellsaftvakuole mit der sie umschließenden Vakuolenwand und andere Vakuolen. 9. Allgemeines über die organischen Reservestoffe. 10. Die Reservestoffkohlehydrate der Bakterien. Das Glykogen und das Iogen. Makrochemie der Kohlehydrate. Vorkommen des Glykogens und bei den Bakterien. 11. Die Fette. Die Reservefette der höheren Pflanzen und der Pilze. Das Fett der Bakterien in chemischer Beziehung. Eigenschaften der Fetttropfen der Bakterien. 12. Das Reserveeiweiß im weitesten Sinne, besonders das Volutin. 13. Die Schwefeleinschlüsse. 14. Der im Zytoplasma liegende Farbstoff der Purpurbakterien. Die Farbe der Bakterien. Das spektroskopische Verhalten der Farbstoffe der Purpurbakterien. Beziehungen zwischen dem Farbstoffe und der Reizbewegung der Purpurbakterien. Ist der Farbstoff der Purpurbakterien ein Chromophyll?

Die Ungleichwertigkeit und das Widerspruchsvolle der über die Bakterienzelle handelnden Arbeiten machten es nötig, daß ein Gelehrter, welcher die nötigen botanischen und zoologischen Vorkenntnisse besitzt und sich selbst eingehend mit der Morphologie der Bakterienzelle beschäftigt hat, daran ging, eine Sichtung des spröden Materials vorzunehmen. Es ist auf diese Weise in dem vorliegenden Werk eine grundlegende kritische Darstellung über das Wesen der Bakterienzelle entstanden, die für die verschiedensten Kreise der Naturforscher von besonderem Werte sein wird.

Vergleichend chemische Physiologie der niederen Tiere.

Von Dr. **Otto von Fürth,** Privatdozent an der Universität Straßburg i. E. (jetzt Prof. in Wien). 1902. Preis: 16 Mark.

Inhaltsverzeichnis: **Chemische Vorbegriffe.** I. Stickstofffreie Methanderivate einfachster Art. II. Stickstoffhaltige Methanderivate. III. Kohlehydrate. IV. Fette. V. Benzolderivate. VI. Eiweißkörper. — **Einleitung.** Die chemische Zusammensetzung des Protoplasmas. — I. **Blut.** 1. Die Körperflüssigkeiten der Echinodermen. 2.—6. Das Blut der Würmer, Mollusken, Crustaceen, Insekten, Tunicaten. 7. Vergleich des Wirbeltierblutes mit dem Blute der Wirbellosen. — II. **Die Atmung.** 1. Die Organe der Atmung. 2. Respiration der Wasserbewohner. 3. Die Atmung der Landtiere. — III. **Die Ernährung.** 1.—8. Die Ernährung der Protozoën, Spongien, Knidarien, Echinodermen, Würmer, Mollusken, Crustaceen, Arthropoden (exklusive Crustaceen). 9. Vergleich der Ernährungsvorgänge der Wirbeltiere mit denjenigen der Wirbellosen. — IV. **Die Exkretion.** 1. Die Exkretionsvorgänge bei den niedersten Tierformen. 2. — bei den Mollusken. 3. Exkrete der Crustaceen. 4. — der Arthropoden (exkl. Crustaceen). — V. **Tierische Gifte.** 1. Gifte bei den niedersten Tierformen. 2. Giftige Mollusken. 3. Giftige Arachnoideen und Myriopoden. 4. Giftige Lepidopteren und Hymenopteren. 5. Giftige Coleopteren. — VI. **Sekretion besonderer Art.** 1. Farbstoffsekretion der Mollusken. 2. Mucine und Mucoide. 2. Die Seide. 4. Das Wachs. — VII. **Die Muskeln.** 1. Die Muskeleiweißkörper und ihre Beziehungen zur Wärmestarre. 2. Extraktivstoffe der Muskeln. — VIII. **Die Gerüstsubstanzen.** 1. Die Gerüstsubstanzen der Spongien und Cölenteraten. 2. — der Echinodermen und Würmer. 3. Das Conchiolin. 4. Die Cellulose der Tunicaten. 5. Das Chitin. 6. Ueberblick. — IX. **Die Farbstoffe der Gewebe.** 1. Die physiologische Bedeutung des Chlorophylls im Tierreiche. 2. Pigmente der niedersten Tierformen. 3.—6. Pigmente der Echinodermen, Würmer und Mollusken, Crustaceen, Insekten. Ueberblick. — X. **Reservestoffe und Aschenbestandteile.** 1. Das Glykogen. 2. Die Fette. 3. Die Kalksalze. 4. Die Aschenbestandteile. — XI. **Die Produkte der Sexualdrüsen.** 1. Das Sperma. 2. Das Ei. 3. Parthenogenese infolge Einwirkung chemischer Agentien. — XII. **Die chemischen Existenzbedingungen wirbelloser Tiere.** 1. Die zur Entwicklung tierischer Organismen notwendigen anorganischen Stoffe. 2. Die Anpassung mariner Organismen an das Süßwasser. 3. Die Anpassung von Süßwassertieren an Salzwasser. 4. Die Einwirkung toxischer Agentien auf niedere Organismen. — **Register** (27 S.).

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